# Mosquito News

Vol. 3, No. 4 DECEMBER, 1943

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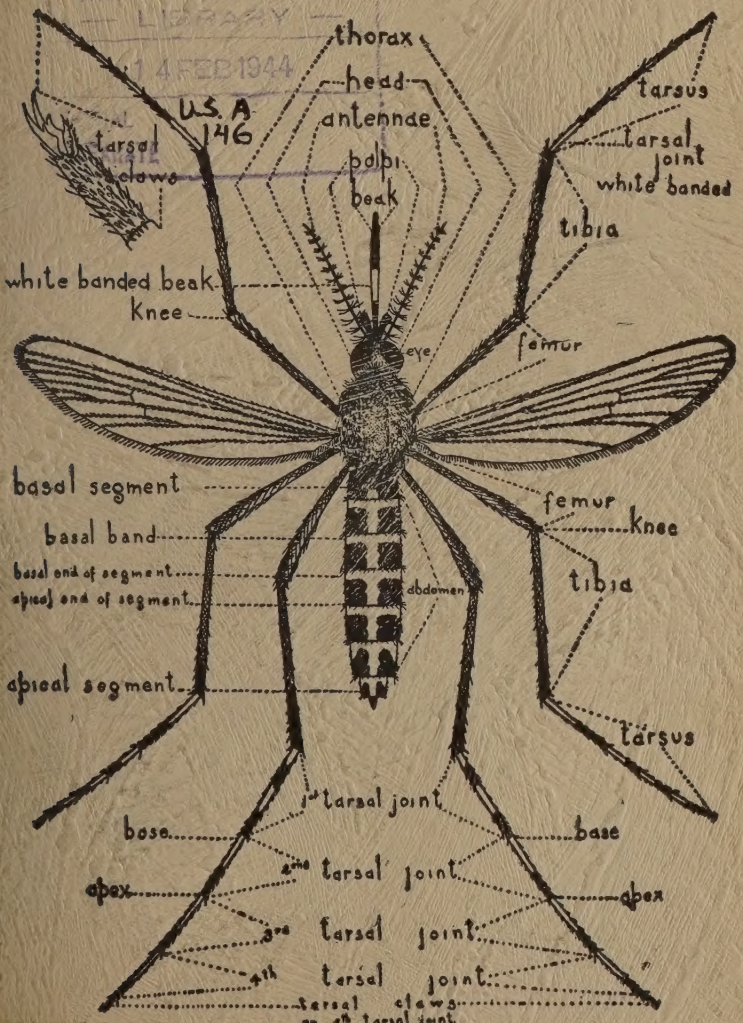


*Issued Quarterly By*
EASTERN ASSN. OF MOSQUITO CONTROL WORKERS

# INDIAN MOSQUITO PUMPS

*for*

## MOSQUITO CONTROL WORKERS

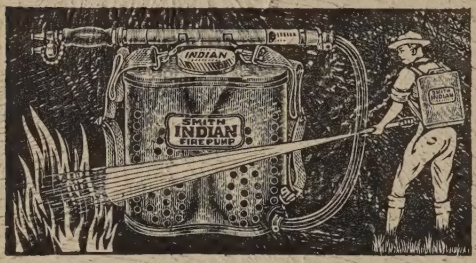


FIG. 1

*Fig.* 1. *SMITH INDIAN MOSQUITO PUMP*

is a 5-gallon galvanized tank equipped with double action pump and ADJUSTABLE NOZZLE. This outfit has a minimum of movable parts to wear or break. It is an ideal sprayer for both oil and pyrethrum larvicide spraying.

*Fig.* 2. Illustrates the ease in which the tank may be carried by hand, filled in the field and carried slung on the back, leaving the arms free to direct the spray or adjust the nozzle for long distant or fog mist.

The INDIAN MOSQUITO PUMP is highly endorsed for spraying for mosquito control work and many are in use for such purposes.

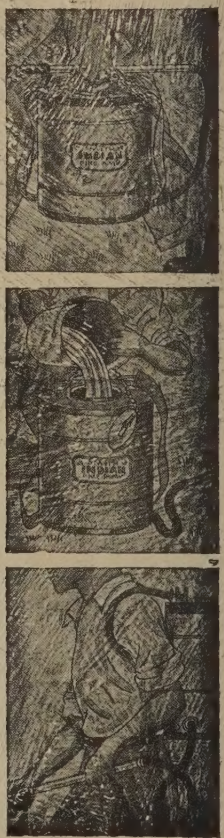

FIG. 2

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## TABLE OF CONTENTS


| | Page |
|---|---|
| **Biography** | **124** |
| **Editorial Section** | **125** |
| **Business of Eastern Association** | **126** |
| **World Wide Mosquito Control** | **128** |
| **Activities of Member States** | **134** |
| **Developments in Mosquito Control** | **137** |
| **Personal Notes** | **152** |
| **Application for Membership** | **153** |



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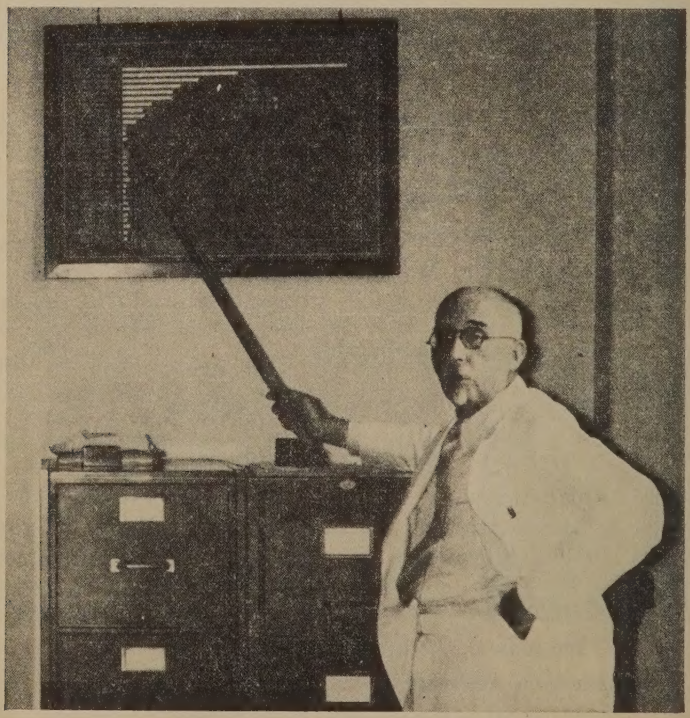
## DALFERES PENNINGTON CURRY

Dalferes Pennington Curry, Doctor of Medicine, engineer, officer of the Medical Corps of the United States Army, sanitarian and a student of mosquito control in the Panama Canal Zone and the Republic of Panama. From the University of Kentucky Dr. Curry received his medical degree in 1903. In 1914 he became Sanitary Engineer and Chemist for the State of Kentucky. In 1917 he joined the United States Army as a Captain in the Medical Corps, rising to the rank of Major in 1919. Dr. Curry was then created Assistant Chief Health Officer for the Panama Canal Zone where he had to meet sanitary problems of all sorts. In this position he continued until 1942 when he was retired. He is now living at Arcadia, R.F.D. 3, Columbia, South Carolina.

Dr. Curry's first experience with mosquito control problems occurred

(Continued on Page 131)



Dr. Curry exhibits chart of malaria case rate in Canal Zone, while entertaining Eastern Association of Mosquito Control Workers in his office in Balboa, Feb. 6, 1938. First bar on chart represents condition existing in 1906. Succeeding bars represent following years, up to 1937.

## EDITORIAL SECTION

One of the contributions of mosquito control organizations to the war effort had been the provision of trained workers to the Army and Navy and Public Health Service. Many Mosquito Commissions have released their key men so that the armed services may benefit by their experience. It is a source of pride to the Mosquito Control workers left in civilian life to know that their former associates are combating malaria in the South Pacific, constructing ditches in Africa or driving the Anopheles out of the areas around the camp sites in the various infected areas in this country.

Malaria is the fifth column in our midst. The Germans and the Japanese are more or less in the open where they can be shot at but the Anopheles mosquito is a small elusive thing that must be fought by the experience of many years. The greatest load of course falls on the doctors who prescribe repellants and medicines and care for the patients. But the work of the doctor is made immeasurably easier by the work of the field operator who ferrets out the breeding places, destroys the larvae and generally reduces the mosquito populations.

A limited supply of trained operators in the mosquito control field was readily available on account of the training received in the different civilian organizations in many parts of the country. When war broke out essential men in these organizations hastened to volunteer to help their country. That their work has been well done is attested to by the fact that malaria has been under such good control.

To all of these men this magazine wishes the best of luck. We appreciate the hardship some of them have endured and also their unflinching perseverance in their job.

THE EDITOR

# BUSINESS OF EASTERN ASSOCIATION

## NEWS OF THE ASSOCIATION

Since the last issue of Mosquito News was distributed, the Committee on Meetings and Inspections has investigated the possibilities of arranging a field study in the Carolina-Virginia area to see some of the new developments and accomplishments of the various agencies. However, many of the most interesting items are in areas rigidly restricted to the respective army or navy personnel concerned, and it also happens that an inspection in this area would of necessity involve considerable travel by auto. It was therefore determined to be at this time impracticable to schedule an inspection in this section.

Nevertheless, there are now before the Association matters which require the holding of a meeting: policy for 1944 must be determined, the proposed new constitution, gotten up by the special committee headed by Dr. Cory must be acted upon, an opportunity to discuss some of the recent developments in control practices should be afforded the membership, and elections of officers for 1944 must be held. Action on the report of the constitutional committee is of very great importance, for if adopted, the new document would change the name of the group to The American Association of Mosquito Control Workers, and would otherwise provide for cooperation, affiliation and activities of mosquito workers on a hemisphere basis, and would also simplify the procedure for conducting the business of the Association. The President has directed that arrangements for the Annual Meeting be made, and negotiations leading thereto are now under way. When the meeting is scheduled, notices will be sent individually to all members.

Membership continues to grow, among civilians and among the mosquito fighting representatives of the armed services. This is encouraging, especially in view of the immediate needs for mosquito protection for the service forces, and the now generally recognized probability of wide spread epidemics of mosquito borne diseases even in areas where they have long been of little or no moment. With the winning of the war, we may look forward to mosquito control on a much broader scale than heretofore—partly to combat mosquito borne disease, and partly due to the many who have seen the current effective mosquito control measures and the results thereof being unwilling to return home to live in mosquito infested localities. The possibilities for service by the Association currently are very great; in the future with a broad expansion of anti-mosquito work they would seem to be unlimited.

SECRETARY.

# WORLD WIDE MOSQUITO CONTROL

## FOUR DAYS IN THE MUSKEG

By H. H. Stage
Bureau of Entomology and Plant Quarantine
Agricultural Research Administration
United States Department of Agriculture

In July 1943 I had an opportunity to make a few brief observations on several phases of mosquito ecology in northern Canada. At the request of the Quartermaster General and the Surgean General of the United States Army, Dr. Terris Moore and I were making some practical field tests on mosquito repellents and other field equipment. Two officers and twelve enlisted men were detailed from one of the northern bases to assist us. We made a four-day march into typical muskeg country under conditions almost identical to those of a forced march. We followed no trails; we carried our food, shelter, and all equipment in packs strapped to our backs; and it was up to us to protect ourselves by any means we could use against the myriads of mosquitoes which were constantly present. Our special equipment included several kinds of head nets, clothing, footgear, sleeping bags, pup tents, and insect repellents.

The first day the constant swarm of mosquitoes about our ears was not too annoying, but by the end of the second day their ever-present proximity began to wear on all members of the party. The hours of sunlight were long, since the sun rose between two and three o'clock in the morning and did not set until about eleven o'clock at night, and even at dusk, when the temperature was high enough, mosquitoes were abroad and in search of blood meals.

Some of our sleeping bags were designed to give protection from mos-

Near the Arctic Circle **Aedes nigripes** is the only species found in water which seldom reaches 40°F. This willow, our guide informed us, is one of the tallest for several hundred miles around.

quitoes without the aid of a tent. These bags were satisfactory as far as they went—at least the mosquitoes could not bite through the materials—but it was difficult to get in and out of the bag without numerous bites and, likewise, it was difficult to allow an opening that would admit sufficient air and yet exclude the mosquitoes.

It was really a relief to each one of us when his turn came to spend a night within the confines of a pup tent. Even then, although the tent was equipped with a door of mosquito netting and a canvas door, dozens of mosquitoes slipped through when we crawled inside.

I had with me a couple of bombs of aerosol, and each night released a small amount of it in the tents after the occupants had completed their sleeping arrangements. As I made my final round one evening, I estimated rather closely 1900 mosquitoes roosting on one of the tents. The following morning I counted in the ventilator 126 dead mosquitoes, which had been carried inside by the two occupants. We were all grateful for these aerosol bombs, for they contributed largely to our comfort during the night spent in a tent.

We prepared our meals in the open, using equipment that we wanted to test under field conditions. The mosquitoes were thick at all times, even in considerable smoke, and all our meals were well seasoned with these insects.

The country through which we traveled was heavily overgrown with dwarf willows, spruce, and larch, and wet, boggy moss covered the ground. Although the water was not very deep, our feet were wet practically all the time. Our march was further complicated by low temperatures at night and high temperatures during the day.

With some difficulty we found small patches of ground that were high and dry enough to make camp. Drinking water, chlorinated, was obtained from the pools nearby, which only a week or two before were seething with **Aedes nearcticus** and **A. cataphylla.** The predominating vegetation was black spruce, larch, and willow, and in many places it was almost impenetrable.

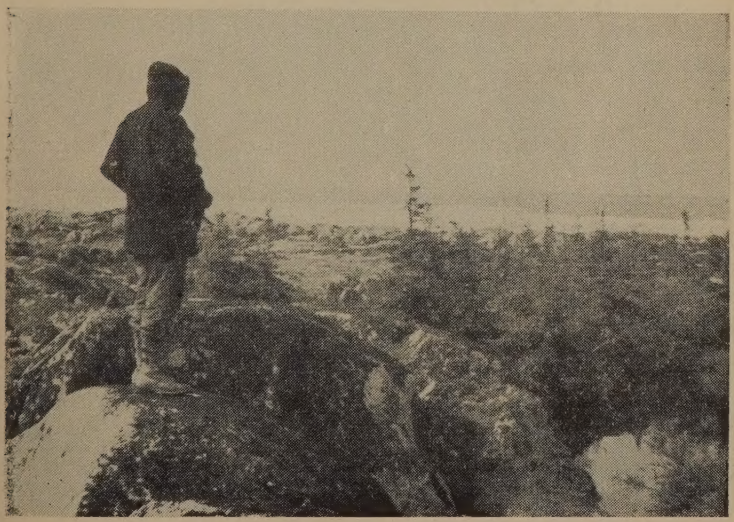
In addition to arduous travel, we found it somewhat hard to locate a spot of ground high and dry enough in which to make camp. There were no running streams of water which we felt were safe to drink, and therefore all water supplies had to be chlorinated.

The mosquitoes observed close to the Arctic Circle were all of a single species, **Aedes nigripes.** A few hundred miles south these gave way to **A. cataphylla** and **A. nearcticus,** and still farther south they were succeeded by **A. flavescens** and **A. vexans,** which occurred to the American border. **A. cinereus, A. dorsalis, A. spencerii,** and **A. excrucians** were also present in the last association, but they were not taken in large numbers.

Some idea of the tremendous area over which these mosquitoes breed in prodigious numbers can be gained by referring to a map of northern Canada. The muskeg and tundra extends three or four thousand miles east and west and at least a thousand miles north and south. I believe I saw a representative section of that vast, unpopulated region, and over practically every square mile of it were large and small pools of water fed from below by melting ice.

**Aedes vexans** and **A. flavescens** were first seen in early June, **A. nearcticus** was abroad the last week in June, whereas **A. cataphylla** did not put in an appearance until July. The first adult **A. nigripes** was seen on July 5 within a hundred miles of the Arctic Circle. This species was not so abundant as the others, and I saw no other species associated with it.

I cannot imagine how the tremendous hordes of mosquitoes were able to obtain blood meals in these trackless wastes, for in much of the area visited there was practically no sign of animal life. Before the mosquito season the herds of caribou migrate northward beyond the range of all but **A. nigripes,** although a few lag behind. There are a few birds and indications of foxes, but scarcely any other animals. The great numbers of mosquitoes and the



A rocky cliff on the western shore of Hudson Bay. Beautiful pools of clear seep and rain water held by the rocks produce **Aedes cataphylla** in late June or early July.

apparent lack of suitable food made me wonder if they can lay fertile eggs without blood meals.

Most of the observations recorded were made close to the northern limits of tree growth, where **Aedes nearcticus** and **A. cataphylla** were numerous. Plant specimens collected from this region were determined as follows by S. F. Blake, senior botanist in the United States Department of Agriculture: Willow, **Salix** sp.; Labrador tea, **Ledium groenlandicum**; sedge, **Carex** sp.; lousewort, **Pedicularis** sp.; Alpine bearberry, **Arctostaphylos rubra**; buffaloberry, **Shepherdia canadensis**; crowberry, **Empetrum nigrum**; mountain avens, **Dryas integrifolia**; reindeermoss, **Cladonia rangiferina** group; sweet coltsfoot, **Petasites sagittata**; whortleberry, **Vaccinium uliginosum**; black spruce, **Picea mariana**; birch, **Betula glandulosa**; and larch, **Larix laricina.**

At the end of the trip the group voted unanimously in favor of the repellents over head nets and heavy clothing as a means of protection against the mosquitoes encountered in muskeg country.

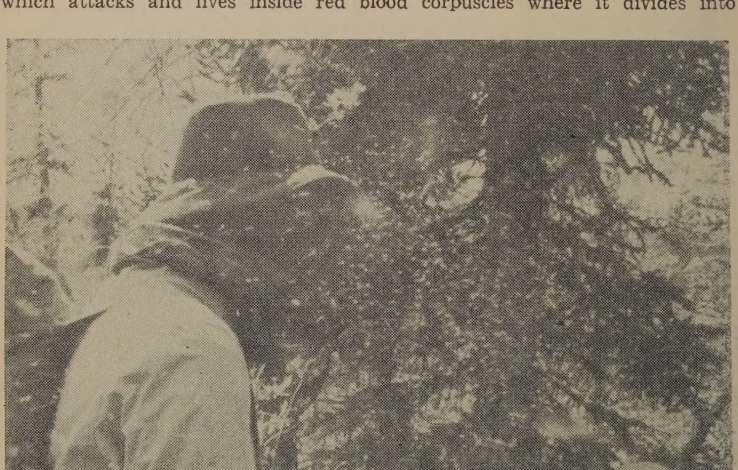
## MALARIA

**Roy F. Feemster, M.D., Dr.P.H., Director**
**Division of Communicable Diseases**

### THE DISEASE

Malaria is a disease in which the fever rises periodically. It was recognized many centuries ago and because it occurred most frequently among people living in low-lying areas covered with swamps and marshes, it was thought to be due to bad air. This explains the derivation of the name. Malaria means literally "bad air."

It was not until 1880 that the real cause of the disease was discovered by a French physician (Laveran) to be a single-celled parasite (protozoan) which attacks and lives inside red blood corpuscles where it divides into



During a 4-day hike in the muskeg the men were constantly surrounded by swarms of 500 to 1500 mosquitoes. Head nets, gloves, and heavy clothing were indispensable when the best mosquito repellents were not used.

numerous new parasites. Eventually, the corpuscle is destroyed and the parasites attack new red corpuscles. The length of this cycle varies with the different varieties of malarial parasites. The variety (Plasmodium vivax) prevalent in the United States completes the cycle in 48 hours so that there is a rise in temperature every second day at the time the parasites are breaking down the red cells. According to the Italian way of computing time, this occurs on the third day and this type consequently was called by them tertian malaria. The most dangerous type of malaria which occurs in tropical areas is not characterized by a regularity in the occurrence of fever, largely due to the fact that the people are exposed repeatedly to malaria and there are new crops of parasites breaking out of red cells every few hours.

Until after the discovery of America, there was no satisfactory method of treating the disease. The Spaniards learned from the natives of Peru that the bark of a certain tree could be used to stop the progress of the disease. Thereafter, the use of Peruvian bark, from which we now obtain quinine, rapidly spread throughout all the world. Modern chemistry has supplied additional drugs (atabrin, plasmochin, etc.) which are useful as substitutes or in conjunction with quinine. Unfortunately, these drugs do not always rid the blood of the parasites. A few may lurk in the body for weeks or months and cause the disease to recur when resistance is lowered.

**METHOD OF SPREAD**

It was not until 1898 that the method of spread of malaria was known. At that time, an English physician (Ronald Ross) working in India, proved that certain varieties of mosquitoes could transfer the disease. Up until that time, mosquitoes had not been very carefully studied and were classed with other small flies in the family of gnats. It is now known that there are numerous varieties of mosquitoes which have been classified into several

**DALFERES PENNINGTON CURRY**

(Continued from Page 124)

while he was serving the army and located at Camp Raritan, New Jersey. From this preliminary study he was catapulted into the intensive and extensive mosquito control effort of the Panama Canal Zone. Dr. Curry went deeply into the taxonomy, biology and disease-carrying characteristics of the mosquito fauna of the Canal Zone and the Republic of Panama.

His successful handling of these problems is amply indicated by two facts: first, yellow fever, which the early work in Panama had eliminated, was never able to stage a return during the twenty-three years of Dr. Curry's service; and, second, the reduced malaria prevalence records of the employees of the Panama Canal Zone. Dr. Henry R. Carter estimated that the malaria rate in 1904 was in the neighborhood of 3,000 clinical cases per 1,000 employees. In 1906 when accurate record of these matters began, the showing was 821 cases per 1,000. From this point the rates dropped steadily year by year until 1916, when a rate of 16 per 1,000 was achieved. The average rate of the next 24 years was about 17 per 1,000, with variations in that time from a low of 10 in 1938 to a high of 31 per 1,000. Under the feverish turmoil of construction at the present time the rate for 1942 was about 25 per 1,000. The story of the death rate from malaria is even more encouraging. In 1906 the death rate was 8.78 per 1,000. By 1916, it dropped to 0.06 per thousand and for the next 24 years the rate averaged 0.04 per 1,000. These statistics cover all employees on the Isthmus of Panama of every color and race and include many hundreds or thousands who spend their off hours in their homes in the unprotected parts of the Republic of Panama.

Dr. Curry's work has made a great contribution to the solution of public health problems in the Tropical Americas.

THOMAS J. HEADLEE.

November 13th, 1943.

tribes. The tribe known as Anopheles is the only one which can spread malaria. The members of this tribe vary with the zone and country. The only important member of the tribe east of the Rocky Mountains in the United States is the species called **Anopheles quadrimaculatus.** This species prefers to breed in ponds of still water and thrives best where the water is filled with vegetation. Another variety (Anopheles Punctipennis), not important in spreading malaria, prefers the edges of running streams.

When the mosquito bites a person who has malaria, the parasites contained in the blood of the stomach of the mosquito migrate to the outer wall of the stomach where they rapidly multiply and soon migrate to all parts of the body of the moquito without producing any harm. Among other places, they accumulate in the salivary glands. This cycle takes about ten days to two weeks. Until the migration of the parasites has taken place, the mosquito cannot transfer the parasite to another human. Once it becomes infectious, however, it remains so for a long period of time and may spread the disease to each new person bitten.

It will be seen that in order for malaria to be spread, several conditions must be fulfilled. First, there must be persons who have malaria in the area. Second, there must be the proper species of Anopheles mosquitoes present. Third, it must be possible for the mosquitoes to get to and bite the person with malaria. Fourth, the mosquito must live at least ten days to two weeks before it can transmit the disease. Since thousands of mosquitoes are killed by enemies, winds, rain, and other environmental conditions, usually a large number must bite a person with malaria in order for a few to survive long enough to pass the disease to other people.

**METHODS OF CONTROL**

The control of malaria can be directed along three lines: (1) curing of the disease in all the persons living in an area; (2) keeping mosquitoes away from people, particularly those infected with malaria; (3) eradication of the Anopheles mosquito.

It is difficult to find and treat all of the cases of malaria because the disease varies in intensity. Even if all of the cases could be found, the drugs now available do not in every instance entirely eliminate the malarial parasites from the blood. It is not unusual for persons who have had malaria to have the disease recur after treatment has been stopped. It is evident, therefore, that the treatment of the disease cannot be depended upon to eliminate it from any particular area.

Protection against mosquitoes by careful screening of houses, staying indoors after dusk, spraying dark corners to kill off mosquitoes which may have gotten by the screens, the use of nets when it is necessary to go into swampy areas, the use of repellents, etc., can all be used to prevent access of the mosquito to possibly infected persons, and also to prevent infected mosquitoes from biting well persons. It is evident, however, that if these measures were to be effective, very little work could be accomplished in a mosquito-infested area.

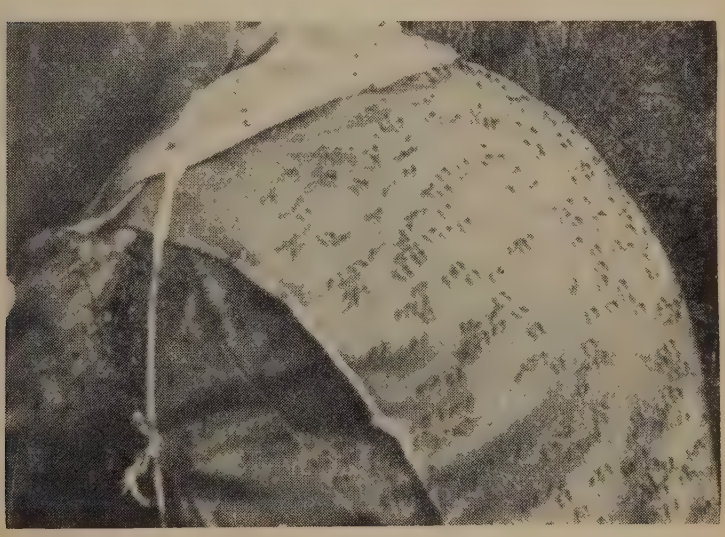
One of the most effective ways of controlling the disease is to attack the mosquito itself. Fortunately, we can direct our efforts against the most dangerous species (in eastern United States, **Anopheles quadrimaculatus).** There are many other varieties of biting mosquitoes but many of them will be breeding in places unfavorable for the Anopheles and consequently control measures can neglect the less dangerous varieties. It is usually economically impossible to attempt to control all mosquitoes, particularly in low-lying areas.

Fortunately, the mosquito is very vulnerable in certain stages of its life history. The Anopheles mosquito deposits her eggs on the surface of ponds.

The eggs hatch within a day or two and the small aquatic larvae, called "wrigglers," begin to swim around the water usually just under the surface. They grow rapidly in size and by the end of a week are almost ready to go into the second stage of aquatic life. This second stage (pupa) is a resting stage in which feeding does not take place. The mosquito is formed inside the shell of the pupa. Within three or four days it cracks the upper portion of the shell and emerges as a full grown mosquito.

While living in the water, the larvae and pupae are devoured by the thousands by their natural enemies (small fishes, larvae of beetles and many other insects, etc.). If they swim into open water, the buffeting by waves will frequently drown them. Often the shallow water in which they have hatched out will dry up before they have passed through the pupal stage and thousands more perish. It will be seen, therefore, that these little aquatic animals have a difficult time to survive, but in spite of this large numbers eventually reach the adult stage.

In planning control measures, we take advantage of many of these natural conditions to aid in eliminating mosquitoes. Often water levels are purposely raised and lowered in order to allow the eggs to hatch in shallow water and insure that the larvae perish by drying before they reach the adult stage. Although the larvae are aquatic animals, they must breathe air. To obtain the air, they push their breathing tubes through the water surface. This makes them very vulnerable to the application of a film of oil on the surface. The oil interferes with their obtaining air, both by making it difficult to push the breathing tube through the surface and by clogging the breathing tube itself. Another method of attacking the larvae is to spray dust containing Paris green on the surface. The larvae feed on the particles of dust and the poison kills them.



The author's back is covered with hundreds of mosquitoes. On the march they were constantly annoying in spite of light rain, temperatures as high as 86°F., and winds of about 10 miles per hour.

The most permanent method of control is to eliminate as many collections of water as possible by filling them in or by draining them off into nearby streams or ponds. Rain barrels should be covered with screens; tin cans, buckets and other vessels buried or turned bottom up. Any kind of a water collection can serve as a breeding place for mosquitoes.

**MALARIA IN MASSACHUSETTS**

Malaria was quite prevalent periodically in New England in Colonial times. It seems to have almost disappeared between these times of high prevalence. There was a rise in the disease in Massachusetts after both the Civil War and the Spanish-American War, due to soldiers returning from southern areas still infected with the parasites. In recent years the disease has practically disappeared. It has been re-introduced in small areas when laborers have been imported from malarial districts. The disease has promptly died out again in each instance, however.

Each year sees Massachusetts become more unfavorable for the breeding of Anopheline mosquitoes. Our ponds are being kept cleaner of protecting vegetation; the marshy areas around the edges of the ponds are being filled in; each time a new house is built the land is graded and water holes are eliminated. These factors together with excellent screening of houses and the prompt treatment of all cases of malaria will undoubtedly insure that the disease will never become a major problem in this State.

It is to be expected that many of those in the armed forces and civilians taking part in the present war will become infected with malaria while on foreign shores. Some of them will have the disease recur after they return home. A few individuals in their households or among their neighbors may acquire the disease. Physicians will be on the alert to discover such cases and the prompt use of drugs will prevent the disease from being any serious problem. Undoubtedly, there will be an increase in the disease within the next two or three years, but the cases will be numbered in tens or scores and not in hundreds of thousands.

## ACTIVITIES IN MEMBER STATES

### HOWARD-KRAUSS SOCIETY

Motto: "Educate to Eradicate Malaria"

**By Annekay Tharp**
**Sponsor Howard-Krauss Society**
**South Side High School**
**Memphis, Tennessee**

The Howard-Krauss Society of South Side High School, Memphis, Tennessee, is a group of senior and junior high school English students, organized to study the importance of malaria control and to pass the knowledge of its importance to others through a medium of student creative expression.

The term "Howard" symbolizes two distinct contributors within the past hundred years to insect-borne disease history—The Howard Association, which served stricken humanity valiantly during the yellow fever epidemics in the United States, the last half of the nineteenth century; and Dr. L. O. Howard, first author to recognize the importance of insect-borne disease control by writing of mosquito control in text books as early as 1901. The name "Krauss" honors Dr. William Krauss, who, a veteran of the 1878 yellow fever epidemic in Memphis, literally gave his life in furthering malaria research.

The Howard-Krauss Society was formed in 1936, under the guidance of Mr. J. A. Le Prince, who had previously lectured to classes interested in the annual gorgas Essay Contest. Through the initial influence of Mr. Le Prince

the society has established a library of pamphlets and books, which serve as a basis for its study.

Officers of the society, in accordance with its constitution, direct the weekly and yearly program of the group. Seventy-odd members, through half-hour weekly programs, planned by a student committee and approved by the sponsor, master essential facts of relative importance to laymen in the furtherance of malaria control: (1) They gain a knowledge of the local species of disease-bearing mosquitoes, their habits and the general methods of control. (2) They learn the history of insect-borne disease control, which includes contrasting economic and health conditions of the plague-ridden and plague-conquering eras, as well as the biographical history of pioneer research workers in yellow fever and malaria control. (3) They recognize the economic importance to-day of preventive insect-borne disease measures.

Two educational factors are followed in directing the study program: (1) Students are taught to develop the "seeing-eye" in finding the answer to problems related to nature and man. (2) Students learn that to sell citizens in general on a public service idea

> "Men must be taught as if you taught them not,
> And things unknown propos'd as things forgot."

These principles of education, developed through student-teacher direction, make the Howard-Krauss study not only interesting, but give members pride in contributing their personal efforts.

Important facts relative to malaria control are indelibly impressed upon members by individual and group participation in creative interpretation of such facts. Each member writes an essay, stressing some phase of malaria control importance. Each also participates in a pictoral, dramatic, poetic, musical, or journalistic interpretation of the malaria control theme for presentation to a general lay group of students or citizens.

In preparation of this program other departments contribute their skill and talent, thus integrating the project with the work of the entire school.

The yearly interpretative student treatment of the malaria theme reaches the entire student body of twelve hundred. Through the student body homes in the community are made malaria control conscious. Through student efforts often clubs and organizations in the city are reached as well as hundreds and thousands of other citizens.

During the past eight years interpretations have assumed varied media: parade floats, radio programs, national prize-winning essays, poster displays, exhibits at conventions and fairs, original skits and talks before school and civic groups, and malaria editions of the school paper.

The five hundred-odd alumni who have participated in Howard-Krauss programs are potential voters for the next forty or fifty years. They are trained to recognize the malaria problem and to meet their responsibility intelligently, as individuals and as members of a community.

During the 1941 inspection of mosquito work of the T.V.A. the Eastern Association was favored by an invitation to attend a meeting of the Howard-Krauss Society. All who were present were impressed with the serious purpose of this group of young people, and with the vast amount of knowledge regarding malaria and malarial mosquitoes which they had accumulated. The Society represents an ideal model which high schools in other areas might well be encouraged to emulate.

Of lasting value is the annual spring issue of the eight-page high school paper "The Triple S," which number is gotten out by the Society and which is devoted primarily to items relative to malaria and mosquito control. It represents a worth-while addition to the library of any mosquito control agency. It is to be hoped that the Howard-Krauss Society will continue its publication, and that its sphere of influence may be extended through exchange with other schools. SECRETARY.

## DU PAGE COUNTY

**O. J. Schmidt, County Sanitary Engineer**
**John P. Walsh, M.D., County Health Officer**

DuPage County has had considerable annoyance from pest mosquitoes. Some parts of the county are especially troubled with these mosquitoes and numerous complaints have come from these areas. Most of these breeding places are low, swampy areas usually covered with heavy underbrush.

The DuPage County Health Department has recognized the need for a program of mosquito control through filling and draining low, swampy areas which constitute mosquito breeding places. Some of our fighting men are now in malaria infested lands and undoubtedly many will return with the parasite in their blood streams. Since the presence of the anopheles mosquito in this area has been recognized for some time, conditions for the spread of malaria are almost ideal; all that is lacking being an infected populace. That link may be completed with the return of these men, creating a reservoir of infection, then an infected mosquito population, and finally the spread of malaria in epidemic form.

The current outbreak of poliomyelitis in the Chicago area has resulted in further studies to determine the possibility of the mosquito as a vector in the spread of this disease. If this proves to be the case then indeed an intensive program on mosquito abatement will become one of the most important features of the public health program now being carried on in DuPage County.

## MALARIA CONTROL IN MARYLAND

**By Dr. Ernest N. Cory**
**State Entomologist**

A Malaria Control in War Areas Project has been set up in Maryland, operating under the direction of the State Department of Health jointly with the United States Public Health Service. The project is for the purpose of controlling the breeding of "quads," to reduce potential malaria transmission in "extra-cantonment zones" of military reservations and in essential war industrial areas.

The project is under the direction of Mr. George L. Hall, Chief Engineer of the State Department of Health, with Mr. Francis A. Jacocks as Assistant Director. The entomological work is being carried on by Mr. George B. Vogt. Dr. E. N. Cory, State Entomologist, Department of Entomology, University of Maryland, is acting in a consulting capacity on the entomological phases of the work.

One of the interesting phases of the project relates to the control of the Anopheles quadrimaculatus in those areas of the Potomac River infested by the water chestnut. Since Virginia and the District of Columbia, as well as Maryland, are vitally interested in this aspect of the program, control operations in the River are being carried on under the direction of a separate unit which functions under the Headquarters Office in Atlanta, Georgia.

## HIGHLAND PARK, ILLINOIS

**By George B. Dana, Chairman of the Board**
**Highland Park Mosquito Abatement District**

The Highland Park Mosquito Abatement District comprising the areas of Deerfield, Bannockburn, Highwood and Highland Park, about eighteen acres in extent has just completed its thirteenth season of operation.

Ditches and ravines which drain the territory have been deepened, widened and cleared of weeds. Stagnant pools and depressed areas have been sprayed with crude oil after each heavy rainfall.

Our district is unique in that it contains the spacious Park where the Ravinia Outdoor Opera renders its Annual Music Festival. These open air concerts given during July and August attract thousands of music lovers. We were informed by many visitors as well as by the management that annoyance there from mosquitoes has been much less than usual, really almost non-existent.

The extensive U. S. Army Post of Fort Sheridan bounds our district on the north. We made inquiry to the Medical Branch of this the Sixth Service Command regarding what measures were being taken to prevent the spread of malarial infection through men returned here from infected foreign areas. In reply the Surgeon General U.S.P.H.S. informed us of the meticulous care exercised by the Army Medical Branch through rigid quarantine and frequent blood tests to see that all such cases are free of infection before leaving their Army Post.

Nevertheless the frequent shifts of civilian and military population due to the war effort has made our work here increasingly important. We hope to continue and expand it next year as much as our funds permit.

Highland Park, Illinois,
November 6th, 1943.

GEORGE B. DANA,
President of the Board.

## DEVELOPMENTS IN MOSQUITO CONTROL

### UNDERGROUND DRAINAGE FOR MALARIA CONTROL

**By Nelson H. Rector, Sanitary Engineer (R)**
**Thomas A. Randle, P. A. Sanitary Engineer (R)**
**Herman L. Fellton, P. A. Sanitary Engineer (R)**
**From Monthly Report of Malaria Control in War Areas**
**U. S. Public Health Service, Atlanta, Georgia**

Underground drainage for malaria control was used by Le Prince and Gorgas in Panama more than 30 years ago. Their drainage systems were constructed of tile laid in narrow contour trenches and covered with broken stone. The trenches were completely filled with broken stone without an earth backfill so that they could carry some surface water. Large stone was placed in the bottom of the ditch and smaller stone in the top layer at the ground surface. To prevent the deposition of impervious material in the voids between the stones, the spoil was placed on the downhill side of the trench.

Satisfactory underground drainage may be constructed of brickbats, rock, gravel, tile or poles covered by a layer of leaves, straw or other filter material and backfilled with earth. Properly constructed drains of this type are inexpensive to install and require little or no maintenance. Some systems have been reported to be giving satisfactory service after more than 50 years of use. Underground drainage as a factor in malaria control is gaining widespread recognition; it has been proved to be one of the most effective methods for permanently eliminating Anopheles breeding places caused by seepage.

Seepage outcrops are caused by a change in permeability of the soil; e.g., a sandy loam topsoil underlain by a clay subsoil. Water flowing through the loam is arrested by the clay subsoil and must flow along this more impervious stratum until it reaches an outcrop on a hillside, stream bank or used in larvicidal control and about 750,000 lineal feet of ditching was completed. During that month, 46 major drainage projects were in operation in 14 states and nearly 20 miles of new ditches were constructed. That Service has carried on a considerable amount of underground drainage such as that used in Panama by LePrince and Gorgas more than 30 years ago. The drainage systems consist of land tile laid in contour trenches on crushed stone of comparatively large size and covered with broken stone of smaller size. The latter is not covered with an earth backfill so that some surface water in

addition to ground water is removed. Spoil is placed on the downhill side of similar location. The line of seepage outcrop may be relatively short or it may extend along the entire toe of slope of a hill and become the source of a marsh or swamp.

Permanent seepage marshes provide excellent breeding places for Anopheles mosquitoes. The water is fresh and abundant vegetation provides food and protection for the larvae. Such areas are generally small, but in some instances marshes and ponds covering several acres have been formed by seepage outcrops. When located near towns or other centers of population. these breeding areas may provide a constant supply of malaria carrying mosquitoes.

It is most important that the design of an underground drainage system




Fig. 1




Fig. 2




Fig. 3




Fig. 4

for the elimination of seepage areas be properly planned and executed. In general, a deep, narrow trench is constructed just above the toe of slope of the hill, and this trench usually follows a contour (Fig. 1). The depth of the trench will be determined by the elevation of the seepage stratum and by the elevation of the outlet ditch. Whenever possible, the ditch should be at least 3 feet deep. A 2-inch earth auger or post-hole digger may be used for locating the depth of the water table and determining the type of underlying subsoil. This information is indispensible in locating the ditch and establishing the grade. Underground drainage must be executed by an engineer familiar with this work, as the conventional design for land drainage will not be effective. Where the seepage outcrop extends well up on the side of a steep slope, it may be necessary to construct a series of parallel contour ditches only a few feet apart along the side of the hill (Fig. 2). The line of the drain should be as straight as possible, but when line changes occur, the tangents should be

DETAIL OF TILE OUTLET

Fig. 5

STABILIZATION OF DITCH BANKS

Fig. 6

SUB-DRAINAGE OF DITCHES

Fig. 7

DRAINING SPRING-FED MARSHES

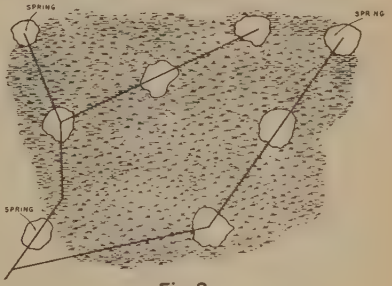



Fig. 8

POTHOLES ALONG BED OF DITCH

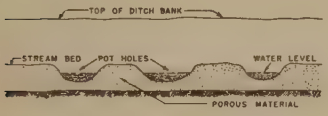



Fig. 9

METHOD OF REPAIR

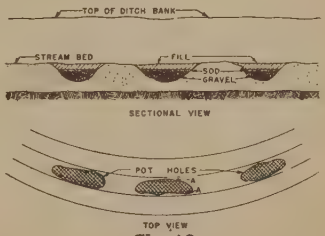



Fig. 10

connected by a smooth curve. Each lateral should enter the main drain at an acute angle.

Narrow trenches, usually from 1 to 2 feet wide will be sufficient for all systems. Generally, it is best not to have the trench longer than 500 or 600 feet. If great care is taken in the construction of the individual ditches in the system, there is no great objection to making the ditches somewhat longer. However, with the average crew, long underground drains are seldom satisfactory. The grade of drains consisting of material other than tile should not exceed 2 feet per 100 feet. Grades of 0.20 to 0.50 feet per 100 feet will tend to make the system more permanent since none of the soil will be lost by erosion. A profile of the system must be made in order to lay a grade suitable to the topography.

Tile, rock, brickbats, stone, poles or other suitable material should be placed in the trench to a depth of from 12 to 18 inches and covered with straw, grass, leaves or brush to a depth of 6 to 12 inches after thorough compaction. The trench is then backfilled to a height of about 1 foot above the original ground level (Figs. 3 and 4). Care must be taken in placing the material in the trench so that voids will be left to allow a free flow of water. When tile is used, it is surrounded with broken stone, above which the straw, grass, hay or leaves are placed in the drainage way. If the soil is very sandy, the filter should extend down around the drain. The backfill should be tamped down to make it as water-tight as possible.

If poles are used as the material in the drains, the joints should not coincide. Experience has proved that failures always occur in the filter when two or more joints are placed together. The poles should be from 4 to 8 inches in diameter and 3, 5, 7 or more may be used in the cross-section of the drain, depending on the volume of water to be carried. The placing of materials should begin at the upper end of a ditch so that the chips, debris or flotage will be washed away rather than into the finished drain.

Although poles placed underground and submerged in water will last indefinitely, they deteriorate rapidly when exposed to air and may thereby cause a failure of the whole system. The drain outlet should be protected by building head-walls of brick and mortar, concrete or rock. Two or more joints of tile should be used in the drain at the head-wall to provide further protection for the drainage material (Fig. 5).

Uses of underground drainage for malaria control other than intercepting seepage outcrops are: (1) sub-draining open earth ditches and concrete inverts; (2) stabilizing ditch banks; (3) draining marshes caused by springs; and (4) providing outlets for overflowing drinking fountains and artesian wells (Figs. 6, 7, 8).

If the banks of a ditch are saturated with seepage and tend to cave in or are hard to hold in place, they can be stabilized by using a small underground drain as shown in Figure 6. A narrow trench is dug perpendicular to the seepage outcrop and sufficiently deep to intercept the flow, or to a depth which will permit drainage into the outlet ditch. This drain may be placed as illustrated, or it may be several feet from the edge. The trench should be filled with any suitable material as has already been explained, the filter placed, and the backfill made as in any underground drainage ditch. A joint of small tile is used to carry the seepage water from the drain into the ditch, and should enter the side of the invert at an acute angle.

Figure 7 illustrates the method for sub-draining open earth ditches and inverts. If a great amount of seepage water is encountered which seems to prohibit the construction of an invert in the ditch, the difficulty may be removed by sub-draining the ditch to lower the water table as shown in the diagram. The drain is constructed directly under the proposed invert and should be from 12 to 18 inches in depth. If the grade of the ditch is sufficient to allow the construction of spillways, the underground drains can be made

shorter and their effectiveness increased. On ditches having a steep grade, the spillway will serve three purposes; namely, decrease the grade of the main ditch, prevent erosion, and make possible the construction of short underground drains.

Sub-draining open earth ditches will eliminate water standing in potholes and behind small obstructions. To prevent erosion, it is desirable to provide spillways on open earth ditches having steep grades. The spillways may be constructed of brick and mortar, concrete or masonry. It is not advisable to use regular curves to break the grade at the spillways as in the case of invert ditches, but rather to use abrupt drops of about 6 inches, making the spillway similar to stair steps. These abrupt drops will tend to decrease the velocity of the water so that erosion of the ditch bottom will be decreased. The banks should be riprapped at the spillways.

Figure 8 illustrates drainage of marshes fed by springs. Springs causing marshes and swamps may be irregularly located with reference to contours and for this reason cannot be eliminated by the regular contour trench. To eliminate the swamp, a system of underground drains consisting of the main ditch and a separate lateral for each spring must be installed as shown in the diagram. The laterals should enter the main ditch at an acute angle. Two laterals should not enter the main ditch directly opposite each other, but should be alternated.

Along ditches through sandy soil or soil containing a large amount of gravel, it will be noted that in dry weather, potholes occur at intervals along the stream bed. Upon close examination it will be observed that the soil between the potholes is quite porous and permits the natural flow of water below the ditch bottom. It will also be observed that this porous material has been washed out to a depth below the hydraulic gradient of the ditch, producing the potholes as shown in Figure 9.

Holes thus formed in the ditch bottom often provide excellent breeding for Anopheles mosquitoes since the conditions are similar to those formed by seepage outcrops. To destroy these breeding places only one thing need be done; that is fill in the missing portions of the porous stream bed. This task may be accomplished by filling the holes to the approximate water level with gravel, using larger stones in the bottom and smaller ones toward the top. The gravel should be covered with a thick layer of sod turned grass side down, and the job completed by covering the sod with a compacted layer of dirt to the original elevation of the stream bed.

If the holes are large, it will be advisable to fill in the sides with dirt to provide a narrow channel before placing the rock or gravel. Considerable time will be saved by following this method since a much smaller amount of gravel or rock will be required. The flow in most cases is small and the narrow channel or drainage way will suffice to carry the water. After the holes have been properly filled, the water flow is below the ditch bottom at all places so that no Anopheles breeding places exist.

The following may be listed as points in favor of underground drainage over open ditches:

1—Completely eliminates mosquito breeding and hence obviates any need for inspection or larvicide work.

2—Low cost of material.

3—Low cost of construction (costly supervision not necessary).

4—Low cost of maintenance.

5—Permanency.

6—No land lost for right-of-way, since cultivation can be extended over the drain.

7—Can be used where other types of drainage are impossible.

The two most important factors relating to any malaria control drainage project are the ultimate cost, and the permanency of the system. When properly planned and executed, underground drains are not expensive to construct and will give many years of satisfactory service free from maintenance. In view of these points, underground drains should be used for malaria control drainage whenever conditions indicate the feasibility of this method.

## OLD SALT MARSH DITCHES

**By William Thom**
**Middlesex County, N. J.**

Why is it that old Salt Marsh Ditches do not function as well as new ditches, even though they are cleaned at frequent intervals?

As time goes on this question will become more paramount in the minds of mosquito control workers throughout the state; at least in Middlesex County we have already discovered its importance, because many of our ditches were installed more than forty years ago and we have observed during the past few years that the marsh areas encompassed by the older ditches do not drain off as rapidly as similar areas surrounded by ditches of recent construction. In many cases, wet areas may be found within a few feet of the old ditches long after the tides have receded and it is apparent that evaporation, rather than percolation, plays the greater part in the removal of water in these areas.

Our marshes are now pretty thoroughly covered with ditches: In fact, we have reached the point where the further extension of laterals would seriously interfere with the harvesting of the Salt Hay Crop. Consequently, we must find other means of draining the marsh surface, or resort more and more to the use of oil and larvicide.

In the approach to the question we have raised, I believe that it would be well, first, to review briefly the structure of a salt marsh.

Salt Marshes are built by the action of the ocean's tides in the deltas of rivers where the silt laden current of the river is retarded by the incoming tide and fans out, depositing silt on either side of its channel. The heavier materials, gravel and sand, find bottom first, usually in the channel and on either side farther up stream while the finely pulverized materials are carried off by the receding tides to be finally deposited in the still water along the more sheltered areas of the shore. As these areas fill up, the deposits are carried further and further outward toward the headlands or to a point where wave action keeps the silt in solution until carried in again by the rising tide.

This process is carried on until the silt has been deposited to such a height that it becomes exposed at low tide, forming what is commonly called a mudflat or young marsh. It is at this point that vegetation first appears. This first vegetation is almost purely aquatic and contains little if any fiberous material.

This growth screens the incoming tides of flotage and by impeding the tidal flow causes a more rapid deposit of fine silt. Evaporation of the tide water now begins to take place and the resulting residue of various salts mingles with the silt. Marsh sod now begins to form. It consists of a more or less porous mass of flotage, roots, etc. held together in a matrix of silt heavily impregnated with brine. This sod layer continues to rise until only occasional tides cover it. As the period of time between covering tides lengthens, the type of vegetation changes and becomes more fiberous with longer and more numerous roots.

I have often noticed while walking over a salt marsh that the sod seems to be firmer and somewhat higher near the banks of natural streams while near the upland the marsh appears to be lower and much softer under foot.

This, I believe, is due to the fact, especially where there is a long reach between shore and upland, that trickling tides deposit the greater part of their suspended matter close to the river bank while only the very finest matter can be carried in suspension long enough to reach the edge of the upland where it is generally kept moist by ground water seepage.

At this point one might well ask why it is that the surface of the marsh does not take on more of the characteristics of common top soil, now that it has reached a height where it is inundated only during periods of extreme high tides. I can only answer this question by saying that whereas topsoil is the result of nitrification of vegetable matter plus the action of animalcula in the sod, there appears to be an almost total lack of living organizisms in salt marsh sod while the excessive amount of chlorine present acts as a sterilizing agent there by retarding the disintegration of root stock.

* * * *

The rate of percolation of water through Salt Marsh sod into intercepting ditches has not yet been determined with sufficient accuracy, so far as this writer knows, to permit one to quote velocity of flow in feet per hour or discharge in gallons per acre per hour, for many factors are involved; to wit: Spacing of ditches, their depth, period of time between high and low water, density of the sod, type of vegetation and weather conditions. Hence, the proper spacing of ditches to obtain maximum effect depends entirely upon the experience of the designer. In some areas, ditches spaced as much as three hundred feet apart seem to work as well as those spaced at one hundred feet in other areas. When laying out drainage systems on virgin meadows, some designers install only alternate laterals and later add to the grid as conditions warrant.

Water is removed from the surface of a ditched marsh by a number of natural forces: It flows over the surface directly into the ditches: Evaporation may remove as much as fifty percent of it. Percolation through the sod to the ditches accounts for the balance of it except that portion which is removed by the capillary action of plant life and as this action exerts an upward force, it probably retards percolation to some extent.

In endeavoring to answer the question posed at the beginning of this article, I believe we can safely confine ourselves to a study of the processes of percolation and its concomitant, "leaching." Having no authentic data at hand, the argument must be based entirely upon supposition.

Due to tidal action on the Salt Marsh, percolation is intermittant; the hydraulic gradient and the velocity of flow is constantly changing and the direction of flow may even be reversed for a short period near the peak of high tide.

As the water moves through the sod toward the ditches it carries with it the finer particles of silt and salts which are deposited in the ditches in the form of a soft sludge. As the tide rises in the ditches this discharge (leaching) is checked, and the suspended material slowly fills the interstices of the sod along the edges of the ditches, thereby gradually "raising and reducing" the hydraulic gradient of the sod.

It is this intermittent process of leaching that slowly increases the density of the soil along the edges of ditches, thereby reducing their efficiency and is, I believe the chief cause for the appearance of false alders.

In seeking a remedy for this trouble with our ditches, we sliced the sides of our older ditches with a hay knife but found that the improvement was negligible. We have now resorted to the use of a mole plow to restore the efficiency of our ditching systems and so far as we are able to judge at this time, it appears to be the answers to our problem.

In using the plow, the mole is kept up in the sod and cuts are made at intervals of about twenty-five feet, cut through from ditch to ditch, so if we assume that the mole hole drains both ways from its mid length, each cut would drain about twenty-five hundred square feet of meadow surface. By this means, the direction of flow of water through the sod is changed and the length of flow is reduced from approximately one hundred feet to twelve feet. As the blade of the plow cuts a slot only about two inches wide, no damage is done to meadows where hay is harvested.

We are not prepared to state how long these mole holes will remain effective but even if we have to open new cuts at intervals of three years we believe that we will have reduced the amount of oiling necessary to maintain control, to such an extent that the mole plow will prove to be the more economical method of control.

## MALARIA CONTROL FROM A SANITARY ENGINEERING POINT OF VIEW

**By Edward Wright, Chairman**
**Massachusetts State Reclamation Board**
**July 9, 1943**

History has been made by engineers and physicians in the control of malaria and other mosquito-borne diseases in such mosquito-infested regions as Cuba and Panama and in other tropical countries. Monuments have been erected to the pioneers such as Ross, Reed, Gorgas and LePrince. In fact, it can be considered that the Panama Canal is a monument to the mosquito control work carried on by the American engineer after the French had abandoned the work as hopeless because of the mosquito.

We in Massachusetts have not thus far been seriously concerned with malaria except in comparatively minor instances and for some years there has been practically no malaria in Massachusetts other than that imported from other countries. The picture changes with the war as it did somewhat during World War No. I when over 25,000 soldiers who had malaria were invalided home from tropical countries. The records show, according to Dr. L. T. Coggeshall, Professor of Epidemiology, School of Public Health, University of Michigan, that malaria is the most important and most deadly disease in many tropical countries. He has stated that there are over 3,000,000 cases of malaria in Russia, for example, and that at one time there were 88 cases per thousand of population in Panama. There are indications that over 50 per cent of our soldiers in the South Pacific and in tropical Africa now have various forms of malaria. It has been stated that in Liberia 70 per cent of the population have malaria parasites in their blood. The supply of quinine is becoming quite limited in various parts of the world and it is understood that in one tropical country the supply has been sufficient to treat only 40 per cent of the cases. Upon the return of our soldiers from the tropical battlefields to their homes and particularly to the general hospitals now being operated by the U. S. Army, such as those at Camp Edwards, Camp Myles Standish, Fort Devens and that being constructed in Framingham, there is a possibility of a spread of this disease to the civilian population unless the patients are treated in hospitals that are thoroughly screened to prevent access of potential malaria-bearing mosquitoes to the patients, and provided the species of malaria mosquitoes are present in any considerable quantities. Because the parasites may exist in the blood for some years there is also the danger of the spread of this disease when the patients are released if the Anopheles mosquitoes are present in any considerable numbers.

In the report of the Department of Public Health on "The Prevalence of Mosquitoes in the Commonwealth," House Document 2260 of the Legislature of 1941, reference was made to the vectors of malaria; and, the most probable vector, Anopheles quadrimaculatus, was found in that survey in all counties in the State excepting Dukes and Nantucket. The numbers found

in connection with this survey were not particularly great, however, but the Anopheles did comprise 19.3 per cent of the larvae and 5.1 per cent of the adults found in this survey.

The Anopheles mosquito operates largely at night and apparently prefers to bite man indoors; hence, the hospitals where malaria patients may be housed later this summer and until well after the war is over should be thoroughly screened. The Anopheles mosquito is not known to fly to any great distance and control work in and around army cantonments in known malaria regions is not being carried on at distances greater than about one mile from the limits of the cantonment. This is a different picture from that relating to various pest mosquitoes such as the salt marsh variety which is known to travel upwards of 15 miles.

There has been considerable correspondence with the U. S. Public Health Service relative to the use of Federal funds delegated to that bureau for malaria control work in the vicinity of army cantonments and war department hospitals in Massachusetts. The U. S. Public Health Service has set up the so-called "Malaria Control in War Areas" Division of which Dr. Louis L. Williams, Jr., is Medical Director. His office is in Atlanta, Georgia. Under the appropriations made to the U. S. Public Health Service for malaria control no money has been expended for this work in the northern states except in Illinois and apparently it will be necessary to convince the U. S. Public Health Service that malaria is being spread in the northern states before much assistance from the Federal Government can be obtained other than in military reservations. However, after various conferences with representatives of Dr. Williams' office, there is every reason to believe that a careful survey will be made this summer in the vicinity of Fort Devens, Camp Edwards, Camp Myles Standish and in the vicinity of the Framingham General Hospital of the U. S. Army. The post surgeons at the larger cantonments in Massachusetts are cognizant of the possible spread of malaria and are doing what they can to carry on control work in their reservations. Much work has been accomplished in the Fort Devens reservation, in the Camp Edwards reservation and some is now being accomplished in the Camp Myles Standish reservation. A very thorough mosquito control project has been in operation for some years in the vicinity of Camp Edwards. Studies are being made for projects in the vicinity of Camp Myles Standish, Fort Devens and Westover Field.

A late publication of the U. S. Public Health Service, Division on Malaria Control in War Areas, refers to the work being done by the Bureau in the southern states, Puerto Rico, the District of Columbia, California and Illinois, the latter state being the only northern state in which that Division appears thus far to have operated.

This Service has a considerable amount of Federal funds for malaria control in war areas. In the month of April over 5000 pounds of paris green were used in dusting malaria-breeding areas, over 73,000 gallons of oil were the trench. The depth of the trench is determined by the seepage stratum and by the elevation of the outlet. Parallel contour ditches are sometimes constructed. The drain line should be as straight as possible and when changes in line and grade occur, smooth curves should be provided. Profiles are necessary before the drains are laid. Holes and depressions containing standing water are generally filled to grade unless adequate drainage can be provided. Larger aggregate should be used in the bottom filling with finer material toward the top.

In connection with the extensive Tennessee Valley Authority work, much care has been exercised in preventing malaria and a large scale malaria control project has been carried on. This work consists of shore line control including the removal of vegetation, provisions for the control of water levels in the various reservoirs and storage basins, dusting with paris green and larvicidal control by various larvicides. Reports of the TVA show that

the Anopheline mosquito breeds abundantly where there is vegetation along the shores of lakes, rivers, storage reservoirs and ponds but not along such shores where vegetation does not occur. Accordingly, much work has been carried on in removing shore line vegetation and in controlling the water level so that eggs laid in quiet water along the shores can be exposed to the rays of the sun by lowering the water level. This has been effective because the eggs do not hatch even in warmer climates for periods of several days. Drainage of salt marshes is comparatively simple from an engineering standpoint as the marshes generally are practically flat. Fresh water areas cannot be drained so readily because of topographical and soil conditions. Surveys are required. Much dynamiting of ditches has been carried on in the Fort Devens Reservation. Spraying with light oil must be resorted to where drainage is not practicable. The breeding areas thus far known here in this State are not such as to require dusting from airplanes as has been done in certain states. Comparative rainfall records must be studied. Most important of all is the work of the entomologist in determining the location of the vectors. This must be followed up by the engineer with plans for drainage of areas pointed out by the entomologist and oiling of known breeding areas where drainage is economically impracticable.

## REFERENCES TO LITERATURE OF INTEREST TO MOSQUITO CONTROL WORKERS

**H. H. STAGE**
**Bureau of Entomology and Plant Quarantine**
**Agricultural Research Administration**
**United States Department of Agriculture**

Anonymous. 1943. Anophelines of the Amazon Basin. Amer. Med. Assoc. Jour. 122: 1028.

———— 1943. Aspectos de la campana antipaludica en la Republica de Panama. Pan Amer. Union Bol. de la Ofic. Sanit. 22: 502-505.

———— 1943. Controle de **Stegomyia** (**Aedes aegypti**) nos portos Brasileiros. Pan Amer. Union Bol. de la Ofic. Sanit. 22: 592.

———— 1943. Insect vectors of poliomyelitis. Amer. Med. Assoc. Jour. 122: 1250-1251.

———— 1943. Malaria. Amer. Med. Assoc. Jour. 123: 211-212, 10 refs.

———— 1943. Malaria is potential health hazard in Michigan. Mich. Pub. Health 31: [143]-144, 146.

———— 1943. Mosquito breeding in static water tanks. Brit. Med. Jour. 4314: 332, 1 ref.

———— 1943. The drug treatment of malaria, suppressive and clinical. Amer. Med. Assoc. Jour. 123: 205-208.

———— 1943. The malaria problem in Australia. Austral. Med. Jour. 1: 539-540.

———— 1943. U. S. Mosquitoes. Only vigorous control will halt spread of epidemics they carry. Life (Sept. 20) 15(12): 79-80, 82, 84, 86.

Anduze, P. J. 1943. **Culex** (**Culex**) **beauperthuyi** sp. nov. (Diptera: Culicidae). Rev. de Sanid. y Asist. Social 8: [459]-461, 4 figs.

———— 1943. Variaciones en huevos de **Anopheles pseudo-punctipennis** Theobald. Rev. de Sanid. y Asist. Social 8: [463]-465, 4 figs.

Aragao, H. B. 1943. O virus do mixoma no coelho do mato (**Sylvilagus minenses**), sua transmissao pelos **Aedes scapularis** e aegypti. Inst. Oswaldo Cruz. Mem. 38: [93]-99, 3 figs., 3 refs.

———— 1943. Uma estacao biologica para o estudo dos mosquitos e dos outros animaes silvestres relacionados com a febre amarela. Inst. Oswaldo Cruz Mem. 38: [21]-37, 7 figs., 4 refs.

Aziz, M. 1943. A simple device for destroying adult mosquitoes, houseflies and other household pests by the use of a flame thrower. Roy. Soc. Trop. Med. and Hyg. Trans. 36(6): 364-365.

Basseres, M. 1943. Atividades da estacao biologica de Perus. Inst. Oswaldo Cruz Mem. 38: [39]-52, 6 figs., 1 table.

Beklemisher, W. N. 1942. Comparative study of life histories of blood-sucking arthropods. Med. Parasitol. and Parasitic Dis. 11(3): 39-44, 13 refs. [In Russian.]

Bennett, A. W. 1943. Malaria endemic in Iowa. Iowa State Med. Soc. Jour. 33: 372-375.

Bishopp, F. C., and Stage, H. H. 1943. A review of mosquito work throughout the world in 1942. N. J. Mosquito Extermin. Assoc. Proc. 30: 97-118.

Bispham, W. N. 1943. Malarial immunity. South. Med. Jour. 36: 636-639, 12 refs.

Botsford, R. C. 1943. Civil mosquito control in Connecticut in wartime. N. J. Mosquito Extermin. Assoc. Proc. 30: 79-80.

Boyd, M. F. 1943. The national malaria society; a sketch. Natl. Malaria Soc. Jour. 2: [15]-23, 27 refs.

———— and Russell, J. C. 1943. Preliminary observations on the inheritance of susceptibility to malaria infection as a character of **Anopheles quadrimaculatus**, Say. Amer. Jour. Trop. Med. 23: 451-457, 1 table, 1 fig., 7 refs.

Bradley, G. H. 1943. Density of **Anopheles quadrimaculatus** and the prevalence of malaria. N. J. Mosquito Extermin. Assoc. Proc. 30: 20-21.

———— 1943. Determination of densities of populations of **Anopheles quadrimaculatus** on the wing. N. J. Mosquito Extermin. Assoc. Proc. 30: 22-27, 2 tables, 2 refs.

Bruce, C. O., Knigin, T. D., Yolles, S. F., and Graham, A. E., Jr. 1943. Report on species of **Anopheles** in British Guiana. Amer. Jour. Trop. Med. 23: 437-444, 1 table, 9 refs.

Cameron, T. W. M. 1942. The parasites of man in temperate climates. Toronto. 182 pp., 164 figs., 3 charts, 48 refs.

Chabelard, R. 1942. La diagnose differentielle entre **Anopheles hispaniola** et **Anopheles sergent**. Arch. de L'Inst. Pasteur D'Algeria. 20: 139-146, 4 figs. [In French.]

Clark, H. C. 1943. Review of recent research on drug prophylaxis and treatment of malaria. (A report to the National Malaria Society.) Natl. Malaria Soc. Jour. 2: [31]-38, 24 refs.

Clarke, J. L. 1943. Flight range and longevity of mosquitoes dusted with aniline dye. N. J. Mosquito Extermin. Assoc. Proc. 30: 227-234, 2 tables, 1 fig.

Coggeshall, L. T. 1943. Current and postwar problems associated with the human protozoan diseases. N. Y. Acad. Sci. Ann. 44: 195-203, 6 refs.

———— 1943. Malaria control along an air route through Africa. N. J. Mosquito Extermin. Assoc. Proc. 30: 32-38.

———— 1943. War malaria. Med. Clin. No. Amer. 27(3): 617-631, 1 ref.

Cory, E. N. 1943. Special problems in civil mosquito control work in war times in Maryland. N. J. Mosquito Extermin. Assoc. Proc. 30: 77-78.

Cova-Garcia, P. 1943. Penetracion y dispersion en Venezuela de las especies **Anopheles (Nyssorhynchus) darlingi** y **Anopheles (Nyssorhynchus) albimanus**. Rev. de Sanid. y Asist. Social 8: [467]-472, 1 map, 8 refs.

Culley, W. M. 1943. Mosquito control in and about military reservations of the Second Service Command. N. J. Mosquito Extermin. Assoc. Proc. 30: 87-89, 1 table.

Curry, D. P. 1943. Twenty-three years' experience in malaria control in the Canal Zone. N. J. Mosquito Extermin. Assoc. Proc. 30: 59-70, 1 fig.

Davies, G. M. 1943. Post-blitz disinfestation of pest-breeding grounds in decomposing foodstuffs. Med. Off. 69: 198-199.

Davis, M. 1943. Malaria. Good Housekeeping (August), pp. 22, 153-154, 1 fig.

Deutschman, Z. 1943. Malaria in North America and the Caribbean region apropos of "a symposium of human malaria." Geog. Rev. 33: [487]-491, 18 refs.

Dorer, R. E. 1943. The influence of dry weather on mosquito breeding. N. J. Mosquito Extermin. Assoc. Proc. 30: 73-74.

Faust, E. C. 1943. Malaria mortality and morbidity in the United States for the year 1941. Natl. Malaria Soc. Jour. 2: [39]-46, 2 tables, 2 figs., 14 refs.

Fine, J., and Livny, Dr. 1943. Filariasis in the Middle East. Brit. Med. Jour. 4314: 327-328, 2 tables.

Fonseca, J. A. B. da, and Fonseca, F. da. 1942. Transmissao da malaria humana por Anofelimos da serie **Tarsimaculatus.** Butantan Inst. Mem. 16: [93]-[148], 8 tables, 24 figs., 53 refs.

Galindo, P., and Kelley, T. F. 1943. **Culex (Culex) thriambus** Dyar a new mosquito record for California (Diptera, Culicidae). Pan-Pacific Ent. 19: 87-90, 8 refs.

Geiman, Q. M. 1943. Advances in malaria research. New England Jour. Med. 229: 283-290, 78 refs.

Giltner, L. T. 1943. Sleeping sickness. Cattleman 30(4): 169-176, 72 refs.

Ginsburg, J. M. 1943. Aerosol sprays for killing and repelling mosquitoes. N. J. Mosquito Extermin. Assoc. Proc. 30:211-216, 2 tables, 25 refs.

Glasgow, J. P., and MacInnes, D. G. 1943. Anopheles of British Somaliland. East African Med. Jour. 22: 176-179, 1 map, 1 table, 2 refs.

Goodwin, M. H., Jr., and Lenert, L. G. 1943. Methods used for investigating certain hydrologic problems related to malaria. Natl. Malaria Soc. Jour. 2: [63]-72, 5 figs., 21 refs.

Gordon, W. M. 1943. Making mosquito surveys with a jeep and the PBY-5. Science 97: 555.

Granett, P. 1943. The significance of the development of mosquitoes to repellents for the protection of military and civilian populations. N. J. Mosquito Extermin. Assoc. Proc. 30: 203-210, 11 refs.

Hardenbergh, W. A. 1943. Malaria and mosquito control in the United States Army. N. J. Mosquito Extermin. Assoc. Proc. 30: 39-43, 6 figs.

Hart, J. T., Jr. 1943. Determining the densities of populations of **Anopheles quadrimaculatus** on the wing by light traps, by nail kegs, by resting places, and by resting and feeding places. N. J. Mosquito Extermin. Assoc. Proc. 30: 28-29.

Headlee, T. J. 1943. Ten years of mosquito trapping in New Jersey. N. J. Mosquito Extermin. Assoc. Proc. 30: 217-227, 1 table, 1 fig.

Highby, P. R. 1943. Mosquito vectors and larval development of **Dipetalonema arbuta** Highby (Nematoda) from the porcupine, **Erethizon dorsatum.** Jour. Parasit. 29: 243-252, 15 figs., 21 refs.

———— 1943. Vectors, transmission, development, and incidence of **Dirofilaria scapiceps** (Leidy, 1886) (Nematoda) from the snowshoe hare in Minnesota. Jour. Parasit. 29: 253-259, 1 fig., 19 refs.

Hopkins, G. H. E. 1943. A larvicide prepared from cotton-seed tar. East African Med. Jour. 20: 41.

Huffaker, C. B. 1943. Summary of some studies on the reaction of mosquitoes to various collecting devices. N. J. Mosquito Extermin. Assoc. Proc. 30: 30-32.

———— and Back, R. C. 1943. A study of methods of sampling mosquito populations. Jour. Econ. Ent. 36: 561-569, 3 tables, 11 refs.

Hutson, L. R. 1943. Canine filariasis. Amer. Vet. Med. Assoc. Jour. 103: 104, 1 fig., 1 ref.

Jordan, H. B. 1943. Blood protozoa of birds trapped at Athens, Georgia. Jour. Parasit. 29: 260-263, 2 tables, 1 fig., 8 refs.

Kelsey, F. E., Oldham, F. K., and Geiling, E. M. K. 1943. Studies on antimalarial drugs. The distribution of quinine in the tissues of the fowl. Jour. Pharmacol and Expt. Ther. 78: 314-319, 3 figs., 1 table, 8 refs.

King, W. V. 1943. Some entomological aspects of troop mobilization. Jour. Econ. Ent. 36: 577-580.

———— Roth, L., Toffaleti, J., and Middlekauff, W. W. 1943. New

distribution records for the mosquitoes of the Southeastern United States during 1942. Jour. Econ. Ent. 36: 573-577, 6 refs.

Kumm, H. W., Bustamante, M. E., and Herrera, J. R. 1943. Report concerning certain Anophelines found near the Mexican-Guatemalan frontier. Amer. Jour. Trop. Med. 23: 373-376, 1 table, 1 map, 9 refs.

———— Bustamante, M. E., and Herrera, J. R. 1943. Informe sobre algunos **Anopheles** hallados en la frontera de Mexico y Guatemala. (1942). [Mex.] Rev. Inst. Salub. y Enferm. Trop. 4: 183-187, 1 table, 1 map, 11 refs.

Lavrenko, E. M. 1942. Morphological differences in the larvae of subspecies of **Anopheles maculipennis.** Med. Parasitol. and Parasitic Dis. 11(3): 30-39, 10 figs. [In Russian.]

Lever, R. J. W. 1943. Further remarks on the common mosquitoes of Viti Levu. Fiji Dept. Agr., Agr. Jour. 14: 42-43, 5 refs.

———— 1943. Malarial islands of Melanesia. Fiji Dept. Agr., Agr. Jour. 14: 58, 1 ref.

Lewis, D. J. 1943. Mosquitoes in relation to yellow fever in the Nuba Mountains, Anglo-Egyptian Sudan. Ann. Trop. Med. and Parasitol. 37: 65-76, 1 map, 4 tables, 3 plates, 17 refs.

Mackie, T. T. 1943. Clinical features of parasitic diseases and their consideration in military and naval operations. N. Y. Acad. Sci. Ann. 44: 251-260.

Manwell, R. D. 1943. Malaria infections by four species of **Plasmodium** in the duck and chicken, and resulting parasite modifications. Amer. Jour. Hyg. 38: 211-[223], 3 tables, 15 figs., 14 refs.

Masters, C. O. 1943. The selective breeding habits of mosquitoes as correlated with specific gravity. Military Surgeon 93: 194-197, 1 fig., 1 ref.

Matheson, R. 1943. Anthropods as vectors of human diseases, with special reference to the present war. N. Y. Acad. Sci. Ann. 44: 225-249, 3 tables.

———— and Belkin, J. 1943. Notes on **Anopheles occidentalis** in central New York. N. J. Mosquito Extermin. Assoc. Proc. 30: [7]-11, 1 table.

McLaine, L. S. Mosquito suppression work in Canada in 1942. N. J. Mosquito Extermin. Assoc. Proc. 30: 51-57, 1 ref.

Mulhern, T. D. 1943. A summary of mosquito control work in New Jersey in 1942. N. J. Mosquito Extermin. Assoc. Proc. 30: 133-179, 4 tables, 6 figs.

Mumford, E. P. and Mohr, J. L. 1943. Preliminary report on the infectious diseases of enemy occupied territories. Part 1: The Japanese mandated islands and Guam. Jour. Trop. Med. and Hyg. [London] 46(2): 15-23, 79 refs.

Netsky, G. I. 1942. Effect of low temperatures on the development of the eggs of **Anopheles maculipennis messae** Fall. Med. Parasit. and Parasitic Dis. 11(5): 24-29, 2 tables.

O'Neill, J. H. 1943. The war and our opportunity for service. Presidential Address. Natl. Malaria Soc. Jour. 2: [5]-13, 5 refs.

Owen, H. B. 1942. Special problems in civil mosquito control work, during wartime, in Philadelphia. N. J. Mosquito Extermin. Assoc. Proc. 30: 71-73.

Patton, R. L., and Metcalf, R. L. 1943. The demonstration of the protozoan parasite of quail malaria by fluorescence microscopy. Science 98: 184, 5 refs.

Redmond, W. B., and Prather, R. M., Jr. 1943. Variations in the asexual cycle of **Plasmodium** when transferred to an abnormal host. Natl. Malaria Soc. Jour. 2: [25]-29, 2 figs., 10 refs.

Renn, C. E. 1943. Emergent vegetation, mechanical properties of the water surface, and distribution of **Anopheles** larvae. Natl. Malaria Soc. Jour. 2: [47]-52, 3 figs., 2 tables.

Ross, E. S. 1943. New and additional Lower California mosquito records. Pan-Pacific Ent. 19: 86, 1 ref.

———— and Roberts, H. R. 1943. Mosquito atlas; part II Eighteen Old World anophelines important to malaria. Amer. Ent. Soc. The Acad. Nat. Sci. Philadelphia. 44 pp., 198 figs.

Russell, A. E. 1943. Mosquito control adjacent to military reservations in the Second Service Command. N. J. Mosquito Extermin. Assoc. Proc. 30: 89-93.

Russell, P. F., Rozeboom, L. E., and Stone, A. 1943. Keys to the anopheline

mosquitoes of the world. 152 pp., 10 figs., 102 refs. Amer. Ent. Soc. The Acad. Nat. Sci. Philadelphia.

Ruth, P. W. 1943. Special problems in civil mosquito control work in wartime in the City of Norfolk, Va. N. J. Mosquito Extermin. Assoc. Proc. 30: 74-76.

Sammis, R. H. 1943. Mosquito work in Nassau County in 1942. N. J. Mosquito Extermin. Assoc. Proc. 30: 78-79.

Schmitt, J. B. 1943. The breeding of **Anopheles crucians** in highly acid waters in abandoned clay pits in Middlesex County, New Jersey. N. J. Mosquito Extermin. Assoc. Proc. 30: 11-16, 2 tables, 4 refs.

Shute, P. G. 1943. Mosquito problems in static water tanks. Roy. Sanit. Inst. Jour. 63: 117-123.

Simmons. J. S. 1943. The present state of the Army's health. Amer. Med. Assoc. Jour. 122: 916-923, 2 tables, 16 charts.

———— 1943. The preventive medicine program of the United States Army. Amer. Jour. Pub. Health 33: 931-940.

Smart, A. G. H. 1943. Some medical problems in the colonies in wartime. Roy. Soc. Trop. Med. and Hyg. Trans. 36: [319]-338.

Stage, H. H. 1943. Mosquito research in the Bureau of Entomology and Plant Quarantine of the Agricultural Research Administration, U. S. D. A. N. J. Mosquito Extermin. Assoc. Proc. 30: 93-97, 4 figs.

———— 1943. Relation of the Bonneville Dam to mosquito control along the Columbia River. N. J. Mosquito Extermin. Assoc. Proc. 30: 197-202, 4 tables, 8 figs.

Talbot, D. R. 1943. New aspects of malaria. Amer. Med. Assoc. Jour. 123: 192-194.

Taylor, D. D. C. 1943. War on mosquitoes. Homes and Gardens 25(3): 44-45, 7 figs.

Townsend, C. H. T. 1943. On the **Nyssorhynchus** complex (Diptera: Culicidae). Ent. Soc. Amer. Ann. 36: 192-194, 7 refs.

Ulitcheva, A. V. 1942. Anophelogenic role of the various types of waters of a rice region. Med. Parasit. and Parasitic Dis. 11(6): 38-47, 7 figs., 1 graph. [In Russian.]

———— 1942. Distribution of the **Anopheles maculipennis sacharovi** larvae through a rice field (Samarkand District). Med. Parasit. and Parasitic Dis. 11(6): 47-52, 3 graphs, 2 tables. [In Russian.]

United States Public Health Service. [1943.] Malaria control in war areas 1942-43. 103 pp., profusely illustrated. [Processed.] Fed. Sec. Serv., Atlanta.

Vannote, R. L. 1943. Protection of war industrial areas and reservations of the armed forces from mosquitoes by civil mosquito work. N. J. Mosquito Extermin. Assoc. Proc. 30: 85-87.

———— 1943. Summary of the Morris County program on its history and present projects. N. J. Mosquito Extermin. Assoc. Proc. 30: 57-58.

Vargas, L. 1943. Los subgeneros americanos de **Anopheles** (Diptera, Culicidae). **Anopheles** (Russellia) **xelajuensis** de Leon, 1938 n. subgn. y **Anopheles (Coelodiazesis) fausti** n. sp. Rev. Inst. Salub. y Enferm. Trop. 4: 57-77, 11 figs., 20 refs. [In Spanish, English summary, p. 71.]

———— 1942. El huevo de **Anopheles barberi** Coquillet, 1903. Rev. Inst. Salub. y Enferm. Trop. 3: 329-331, 1 fig., 4 refs.

Vaucel, M., and Campourcy, A. 1943. L'anophelisme au Cameroun Francais. Rev. Sci. Med. Pharm. Vet. 2: 85-88.

Waletzky, E., and Brown, H. W. 1943. Studies on the mode of action of quinine in avian malaria. Natl. Malaria Soc. Jour. 2: [53]-62, 5 tables, 2 figs., 6 refs.

Wilkinson, H. 1943. A general review of work of the antimosquito campaign. N. J. Mosquito Extermin. Assoc. Proc. 30: 82-84.

Williams, L. L., Jr. 1943. Density of **Anopheles quadrimaculatus** as related to prevalance of malaria. N. J. Mosquito Extermin. Assoc. Proc. 30: 17-20, 1 table, 2 refs.

———— 1943. Malaria control in war areas. N. J. Mosquito Extermin Assoc. proc. 30: 43-50, 2 tables, 2 figs.

Woolley, T. A. 1943. The metamorphosis of the nervous system of **Aedes dorsalis** Meigen (Diptera: Culicidae), Ent. Soc. Amer. Ann. 36: 432-447, 84 figs., 8 refs.

Wright, E. 1943. Special problems in Massachusetts in civil mosquito control caused by the war. N. J. Mosquito Extermin. Assoc. Proc. 30: 80-82.

Yolles, S. F., and Knigin, T. D. 1943. Note on a new transparent cage for collecting and feeding mosquitoes Amer. Jour. Trop. Med. 23: 465-469, 6 figs.

## PERSONAL NOTES

Milton H. Price, Mosquito Control Supervisor for the State of Rhode Island, retired from service last week to take up employment in the Tydol-Tide Water Oil Company, and his services will not be replaced until at least next spring.

Doctor Carl B. Huffaker, formerly of the Delaware Agricultural Experiment Station has recently left the country to take up the duties of his new assignment with the Health & Sanitation Division of the U. S. Office of Inter-American Affairs in Bogota, Colombia, S. A. Dr. Huffaker is by recent application a new member of the Association.

Lieutenant R. J. Hemmings (J.G.) who was connected with the Nassau County Mosquito Extermination Commission is attached to the Air Force of the Navy. His exact whereabouts is not known, but he is apparently in the North African and Italian area of the Mediterranean on malaria control work. His address is Lieut. (J.G.) R. J. Hemmings, U.S.N.R., Fleet Air Wings 15, Fleet P.O., New York, N. Y. We feel sure he will be glad to hear from any of the men in mosquito control work.

Major Russell W. Geis is located in Philadelphia and at the request of the Mayor of that City and with the approval of the Surgeon General of the U. S. Public Health Service, his detail has been extended for an indefinite period.

John Skidmore, formerly employed by the Nassau County Mosquito Extermination Commission and employed for the last year and a half as Chief Engineering Aide of the U. S. Public Health Service, is returning to Long Island on leave from his work in Arkansas, where he has been in charge of malaria control around several large German and Japanese Prisoner-of-War Camps.

Second Lieutenant Walter Abramitis, who was employed as a Senior Engineering Aide on the Media, Pa. Mosquito Control Survey in 1942, has left for overseas duty on malaria control work with the U. S. Army. He is a former graduate student of Doctor Headlee.

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**APPLICATION FOR MEMBERSHIP**

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The purpose of this association is as follows: To promote closer cooperation among its members in the work of mosquito extermination; to attain higher standards of efficiency; to encourage further research; to disseminate information regarding mosquitoes and mosquito control; to work for recognition and cooperation among public officials to secure the enactment of legislation favorable to and leading toward a broader program of mosquito control work wherever it is needed; to combat unfavorable propaganda directed against mosquito work; to protect wildlife in the course of mosquito control work as far as is practicable; to work for a better understanding with related organizations, in order to bring the interests of all into closer agreement.

There are four classes of membership:

1. **Active**—Open to any person engaged upon mosquito control work and any person whose line of professional duty includes work on mosquitoes. Only active members may hold office, or vote on matters of association business. Dues $4.00 per year including subscription to quarterly journal "Mosquito News."

2. **Associate**—Open to any person who has shown by past performance that he or she has been interested in mosquito control activities, or who may desire to become cooperative in furthering the work. Dues $2.50 per year, including subscription to quarterly journal "Mosquito News." Associate members may not hold office or cast a vote on association matters.

3. **Honorary**—Open to persons whose accomplishments in mosquito work have been such as to cause three-fourths of the active membership to feel that the association is honored by their inclusion. Candidates for honorary membership shall be proposed only by the Executive Committee.

4. **Institutional Subscription to "Mosquito News," $3.00.** Includes special institutional membership, entitling organization to receive copies of all information sent to general membership. This classification is intended primarily for libraries, research and educational institutions, etc.

All members shall receive at no cost copies of all notices, announcements, minutes of meetings, and publications.

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